Identification of Vulnerable Communities with High Lead Exposures Residing in Michigan

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Background and Objectives

Lead exposure is associated with numerous harmful effects in children and adults, including adverse neurological, cardiovascular, kidney, developmental, and reproductive outcomes. Exposure to even small amounts of lead can be harmful to a child's developing brain, resulting in detrimental effects on IQ and behavior. Over the past 50 years, lead exposure for the U.S. population has decreased, resulting in lowered blood lead levels. However, there are still likely to be vulnerable communities (i.e., those overburdened with few resources and disproportionately impacted by lead exposures) where significant sources of lead remain that need to be identified to prevent adverse public health outcomes. As such, our objectives were to identify high risk areas in Michigan with elevated blood lead levels, determine the main contributing factors, and develop approaches for future studies to inform exposure reduction efforts.

Methods

We obtained a blood lead dataset from the state of Michigan comprised of measurements from young children (average age ~7 years old) collected over 10 years, totaling ~2.5 million data points. Each individual blood lead measurement was geocoded to determine if neighborhood clusters existed with high lead exposures. We used ARCMAP 10.3.1 ([Getis-Ord Gi*] and Gluster and outlier analysis [Anselin Local Morans I]) to identify communities with high blood lead levels (hot spots) by weighting the number of people with high blood lead levels (e.g., 3.5 or 5 µg/dl) by population or total number of people for blood lead screening. General linear model (GLM) was applied to identify main contributing factors.

Conclusions

- Rate of high-BLL decreasing in MI but slower in higher risk locations than in areas with low-BLL
- Consistent findings for high Pb risk areas by **Reuters analysis** and **EPA/ORD, but ORD approach provides** better geographic and temporal resolution
  - Different GIS methods yield similar results
- Many high Pb risk areas identified in MI with higher rates than Flint
  - e.g., Detroit area
  - Only 3 census tracts in top 100 (All three in 90th to 100th percentiles) in Flint, MI
- Housing age, minority status, income level, and education level are found to be major contributors by GLM

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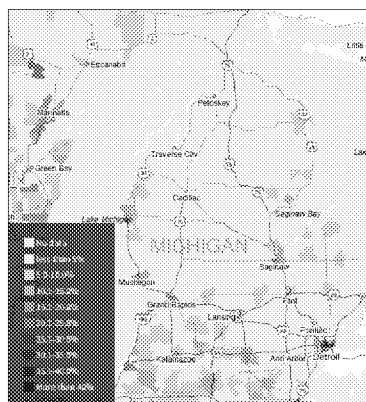EPA Office of Research and Development scientists and collaborators

Disclaimer

Results

Reuters Analyses
Nationwide Childhood BLL Analysis Maps by Zip Code and/or Census Tract

EPA Analyses

Analysis (Anselin Local Morans I) for MI BLL Rate (higher than 5µg/dl) (2014-2016)

Analysis (Getis-Ord Gi*) for MI BLL Rate (higher than 5µg/dl) (2014-2016)

Michigan Census Tracts: Rate of Children Tested with a BLL Above 5 ug/dL
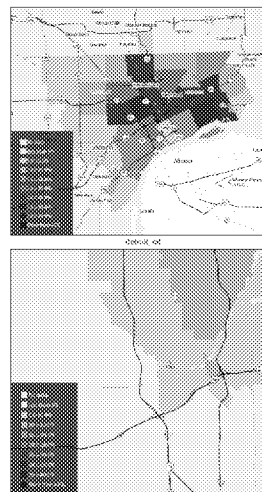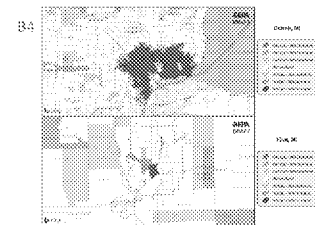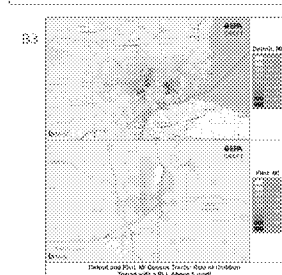
Analysis (Getis-Ord Gi*) for MI BLL Rate (higher than 5µg/dl)(2014-2016)

GLM model for BLL by key variables

Percent BLL Greater Than 5 ug/dL for 0-7 Years Old

Area with high BLL rate (+5%)